CLAIMS

What is claimed is:

1. A system for the reagent-free determination of the concentration of an analyte in living tissue of a patient, the system comprising:

a light transmitter for generating monochromatic primary light;

a scattered-light percutaneous sensor inserted through the skin surface into the skin, wherein a distal end of the percutaneous sensor has a sensor head such that the sensor head pierces the skin;

an inbound light guide in which primary light is conducted through the skin surface into the interior of the body;

a light irradiation surface formed at a distal end of the inbound light guide through which the primary light penetrates into a test volume of the tissue;

a detection light guide which has at its distal end includes a light receiving

surface through which a secondary light scattered in the test volume

penetrates into the detection light guide;

a wavelength-sensitive detection device connected to the detection light guide for detection of Raman-scattered components of the secondary light; and

an evaluation device for determining the concentration of the analyte from the Raman-scattered components of the secondary light.

2. The system according to claim 1, wherein the analyte is glucose.

3. The system according to claim 1, wherein the the light irradiation surface of the inbound light guide and the light receiving surface of the detection light guide are located, subcutaneously so that the test volume contains interstitial fluid.

4. The system according to claim 1, wherein the primary light is irradiated with only one wavelength, the wavelength being such that a spontaneous Raman scattering occurs.

5. The system according to claim 1, wherein the wavelength of the primary light is at most 900 nm, preferably at most 800 nm, especially preferably at most 600 nm.

6. The system according to claim 1, wherein a multivariate analysis method is used for determining the concentration of the analyte from the Raman spectrum.

7. The system according to claim 1, wherein a distal end of the sensor head os enclosed by a semipermeable membrane such that the semipermeable membrane prevents admission of macromolecules having a molecular weight above the exclusion limit of the semipermeable membrane to the test volume.

8. The system according to claim 7, wherein the exclusion limit of the semipermeable membrane is at most 50 kDa, preferably at most 20 kDa.

9. The system according to claim 1, wherein the percutaneous sensor includes a detection light guide ring which surrounds a central inbound light guide.

10. The system according to claim 9, wherein the detection light guide ring is formed by a plurality of optical fibers arranged in a ring pattern around the inbound light guide.

11. The system according to claim 9, wherein the detection light guide ring is formed by a fiber-optic tube which surrounds the inbound light guide.

12. The system according to claim 1, wherein the sensor head includes a reflective surface which reflects the Raman-scattered light such that the primary light

beam emerging from the light irradiation surface is not reflected thereby towards the light receiving surface but a detection range detected by the detection light guide is oriented by the reflective surface towards the primary light beam.

13. The system according to claim 12, wherein the reflective surface is formed by a boundary surface of the detection light guide on the side of the detection light guide which faces away from the primary light beam emerging from the light irradiation surface.

14. The system according to claim 13, wherein the boundary surface is coated with a filter coating which allows the primary light to pass through but reflects the Raman-scattered light.

15. The system according to claim 13, wherein the reflective surface is inclined at an angle (β) between 10° and 40° to the axis (A) of the primary light beam emerging from the light irradiation surface.

16. The system according to claim 13, wherein the distal end of the detection light guide is designed as a transparent ring segment body having a conical reflective surface and a central recess, the recess being aligned with the inbound light guide.

17. The system according to claim 12, wherein the reflective surface is formed by a surface of a reflector element which forms a lateral limitation of the test volume and the reflective surface is inclined to the axis (A) of the primary light beam emerging from the light irradiation surface such that the scattered secondary light is concentrated towards the light receiving surface of the detection light guide.

18. The system according to claim 17, wherein the reflective surface is inclined at an angle (α) of less than 10° to the axis (A) of the primary light beam emerging from the light irradiation surface.

19. The system according to claim 17, wherein the reflector element is a reflecting sleeve surrounding the primary light beam.

20. The system according to claim 1, wherein the percutaneous sensor has a diameter of at most 2 mm, preferably at most 1 mm and especially preferably at most 0.5 mm.